37 C.F.R. § 1.321(c). Please amend the application as follows and reconsider the application in light of the following remarks.

In the Specification:

On page 2, starting at line 1 and continuing through page 3, line 34:

SUMMARY OF THE INVENTION

The present invention provides for separating non-coin objects from coins in a coin-sorting, discriminating or counting device, preferably prior to coins reaching certain coin transport devices, such as transport devices for transporting coins toward a hopper or sensor, preferably prior to coins reaching a coin hopper which provides coins to sensors and preferably prior to the coins reaching the counter/sorting sensors. In one embodiment the separation device is a generally tubular or concave surface, having one or more openings through which non-coin objects travel, and which cause coins introduced thereto to undergo relative movement to assist in separation of non-coin objects. In one embodiment, the relative movement preferably involves lifting some coins with respect to others and may be achieved by pivoting or rotating the tubular or concave surface, e.g., about an axis. Agitation may be further enhanced by projections formed in or attached to the surface, such as vanes, fins, blades, spines, dimples, ridges, and the like. Movement of coins through or across the tubular or concave surface may be effected or enhanced by various mechanisms. Although gravity feed may be used, in one embodiment blades such as angled, spiral or helical blades assist in moving the coins e.g. in a screw conveyor fashion.

Except for coin entrance and exit ports, diameters, sizes or shapes of the openings are configured to prevent passage therethrough of the smallest coin intended to be counted by the counting device. In one embodiment, a drive mechanism rotates the cylinder about is longitudinal axis to agitate the coins therein by lifting coins and, preferably, moving the coins through the cylinder by a screw mechanism.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a coin-counting device of a type which may be configured to incorporate features of the present invention;

Fig. 2 is a rear perspective view of a receiving tray and rib slide of a type which may be provided in the apparatus of Fig. 1;

Fig. 3 is a schematic side view of a feed tray and tumbler device according to an embodiment of the present invention;

Fig. 4 is a schematic depiction of the position of a helical blade in an embodiment of the present invention;

Fig. 5 is a partial side view of a tumbler device according to an embodiment of the present invention;

Fig. 6 is an end view of a tumbler device according to an embodiment of the present invention;

Fig. 7 is a partial perspective view, partially exploded, of a tumbler device according to an embodiment of the present invention;

Fig. 8 is a partial perspective view, partially exploded, of a tumbler device according to an embodiment of the present invention;

Fig. 9 is a rear perspective view of a modular feed tray/tumbler device according to an embodiment of the present invention, which may be incorporated into the apparatus of Fig. 1;

Fig. 10 is a side view of the apparatus of Fig. 9;

Fig. 11 is an end perspective view of the apparatus of Fig. 9;

Fig. 12 is an end view of a tumbler cylinder, according to an embodiment of the present invention;

Fig. 13 is a front perspective view, with exploded cover plate, of an apparatus according to an embodiment of the present invention;

Fig. 14 is a front perspective view, partially exploded, of the apparatus of Fig. 13;

Fig. 15 is a rear perspective view, partially exploded, of the apparatus of Fig. 13;

Fig. 16 is a perspective view, partially exploded, of a trommel assembly, according to an embodiment of the present invention;

Fig. 17 is a perspective view of a first end cap which may be used in connection with an embodiment of the present invention;

Fig. 18 is a perspective view of a trommel body, according to an embodiment of the present invention;

Fig. 19A - D are right side elevational, top plan, left side elevational and end views of a trommel body in open configuration, according to an embodiment of the present invention;

Fig. 19E is a side view of a vane which may be used in connection with an embodiment of the present invention;

Fig. 20 is a perspective view of a long object trap of a type which may be used in connection with an embodiment of the present invention; and

Fig. 21 is a cross sectional view taken along line 21 – 21 of the device of Fig. 20.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 depicts a coin-counting device which may incorporate features of the present invention. Fig. 1 depicts a device in perspective with various doors opened, and a bag trolley 1610a partially withdrawn. In the embodiment of Fig. 1 a coin tray 1402 is mounted pivotally about axis 1414 (Fig. 2), so that a user, after inserting coins in the tray 1402 may lift the tray, using handle 1404, to move coins out of the tray area 1424, over the ridge or peak 1414, and onto a slope 1428, for movement past a gate 1432, and onto a ribbed chute 1406. Coins are moved into a hopper 1604 for transfer to a counter or sorter 1212, where sorted or counted coins are diverted to bins or, in the embodiment of Fig. 1, bags 1608 held in the trolley 1610a, 1610b. Information processing and/or communication devices and/or printers or dispensers 1628, 1874, which may include, e.g., a computer and/or printer may be provided for outputting information about the sorted coins or counted coins, as described, for example, in PCT application PCT/US95/05356 filed May 1, 1995, and/or U.S. application 08/255,539 filed June 6, 1994, both of which are incorporated herein by reference.

On page 5, starting at line 6 and continuing through line 16:

A controllable gate 1324 is mounted transverse to the first chute 1310 to permit rotation from the closed configuration depicted in Fig. 15, blocking passage of coins, to an open configuration permitting passage of coins or other objects past the gate. Preferably the gate 1324 is formed of rubber, e.g., to avoid pinching of fingers. Rotation of the gate 1324 is controlled by a solenoid 1326. The solenoid 1326 is activated in response to a signal from a control device such as a computer or other information processing device 1628, 1874 (Fig. 1). The gate may be controlled to open or close for a number of purposes, such as in response to sensing of a jam, sensing of load in the trommel or hopper, and the like. In the depicted embodiment, signal devices such as LED or other lights 1328a, 1328b, can provide a user with an indication of whether the gate 1324 is open or closed (or otherwise to prompt the user to feed or discontinue feeding coins or other objects). Although instructions to feed or discontinue may be provided on the computer screen (Fig. 1), indicator lights 1328 are believed useful since users often are watching the throat of the chute 1310, rather than the computer screen, during the feeding of coins or other objects.

On page 7, starting at line 20 and continuing through line 28:

In the depicted embodiment dimples 1820 are formed protruding slightly into the interior region of the trommel 1314. The dimples 1820 are believed to facilitate throughput by avoiding adhesion (such as surface tension – induced adhesion) and/or friction between coins and the interior surface of the trommel. The dimples are believed to reduce the likelihood of adhering a customer's coins to the trommel wall, resulting in loss of credit to the customer. It is believed the dimples prevent or reduce surface-to-surface contact of coins with an interior surface of the trommel over a substantial region of the coin face surface and, accordingly, in the depicted embodiment, dimples 1820 are positioned in any location of the interior surface where a flat region of substantial area would otherwise occur (such as regions between holes). Other shapes, sizes, locations and distributions of protrusions, ridges, fingers, and the like may also be useful to facilitate throughput.

On page 8, starting at line 29 and continuing through page 9, line 14:

Another feature which is believed to contribute to the desired lifting/free-fall behavior of the coins or other objects is a provision of one or more vanes protruding into the interior of the trommel 1922a, 1922b, 1922c, 1922d, 1924a, 1924b, 1924c, 1926a, 1926b, 1926c, 1926d, 1928a, 1928b, 1928c, 1928d. It is believed that by positioning vanes at an angle such as about 15° 1930 to a plane passing through the longitudinal axis 1932, the vanes assist not only in providing coin-lifting/free-fall, but also assist in moving the coins in a direction towards the output region 1308. Although it would be possible to provide one or more vanes whose lateral position (with respect an interior surface of the trommel) changed monotonically, it is believed such configuration is not as effective in assisting with movement of coins towards the output portion 1308, as a configuration in which the lateral position of the vane changes non-monotonically. In the depicted embodiment this is accomplished by providing the vanes in several subparts or segments, defining discontinuities or nodes at longitudinal positions 1936a, 1936b, 1936c, 1938a, 1938b, 1940a, 1940b, 1940c, 1942a, 1942b, 1942c therebetween. Without wishing to be bound by any theory, it is believed that a configuration in which the nodes for adjacent sides of the trommel are at similar longitudinal positions does not promote the desired transport of coins towards the output end 1308. Accordingly, the nodes 1936a, 1935b, 1936c, 1938a, 1938b, 1940a, 1940b, 1940c, 1942a, 1942b, 1942c, are perfectly configured such that nodes defined on one surface are at longitudinal positions different from the node positions for an adjacent surface and, preferably, different from node positions for all other surfaces, as depicted. In the depicted embodiment, eleven of the fifteen vane segments are the same length (about 2.7 inches or about 6.8 cm in the depicted embodiment), with the desired node offset resulting in the remaining segments 1922a, 1922d, 1926a, 1928d being shorter.

C4

On page 10, starting at line 3 and continuing through line 29:

The output bearing 1360 is held in position by an end wall 1366. In the depicted embodiment, the end wall 1366 is mounted to the frame 1368 so as to permit the end wall 1366 to be moved so as to allow the trommel assembly 1338 to be withdrawn, e.g., for cleaning or maintenance. In the depicted embodiment, the end wall 1366 is coupled to legs 1372a, 1372b which fit into rails 1374a, 1374b, 1374c, 1374d, to permit sliding movement in an engagement direction 1376a or disengagement 1376b direction. Springs

C5

1378a, 1378b, normally urges the legs 1372a, 1372b, and thus the wall 1366 in the engagement direction 1376a. The springs 1378a, 1378b are sufficiently strong to securely maintain the trommel assembly 1338 in the engaged position (i.e., the position shown in Fig. 13) during normal operation, but permit the output portion 1308 to be moved in the disengagement direction 1376b manually (i.e., without the use of special tools, preferably without the use of any tools) in an amount sufficient to prevent disengagement and withdrawal of the trommel assembly 1338, e.g., for maintenance, cleaning, replacement, inspection, and the like. Preferably, a limit screw 1377a, 1377b provides a stop to prevent the force of the springs 1378a, 1378b from causing the bearing 1360 to thrust against the end cap 1318, undesirably increasing friction. In the depicted embodiment, the tray 1382 is formed in two portions 1382a, 1383b, coupled in a sliding fashion to permit the tray to be collapsed in a direction 1385. Collapsing the tray is believed useful in assisting in tray removal, for certain configurations, e.g., where space is restricted. Preferably the tray 1382 has sufficient capacity that tray emptying is required no more often than about once every two weeks, during normal anticipated use. Other fashions of permitting disengagement or movement of the bearing ring 1360 can be used, such as providing for hinged or pivoting movement. The depicted sliding movement is believed to permit removal of the trommel 1338, e.g., through the open bottom 1382 of the frame, while reducing or minimizing longitudinal space requirements. In the depicted embodiment, an output chute 1374 is provided adjacent the output opening of the trommel. In the depicted configuration the output chute 1374 is configured to direct coins, output from the trommel, in a substantially downward direction 1320. A tapered region 1378 assists in directing the coins.

C5

Preferably, a tray or other container 1382 is located beneath the trommel assembly 1338 to catch dirt which passes through the trommel dirt openings. Preferably, the tray 1382 is configured to be easily removed (e.g., for emptying, cleaning, and/or permitting access to the underportion of the device). In the depicted embodiment, the first edge 1384 of the tray 1382 engages a rail or lip formed on the frame 1368, and the opposite edge 1386 may be rotated upward to engage with spring clips 1390a, 1390b on the opposite side of the frame.

On page 11, starting at line 3 and continuing through page 12, line 2:

In operation, the user of the embodiment of Figs. 13-21 places a mass of coins, preferably all at once (typically accompanied by dirt or other non-coin objects) in the input tray 1402. The user is prompted to push a button to inform the machine that the user wishes to have coins discriminated. Thereupon, the computer causes the input gate 1324 to open (via solenoid 1326) and illuminates a signal to prompt the user to begin feeding coins. When the gate 1324 is open, the motor 1352 is activated to begin rotating the trommel assembly 1338. The user moves coins over the peak defined by the hinge 1414, typically by lifting the tray 1402 at least partially, and/or manually feeding coins over the peak 1414. The coins pass the gate 1396 (typically set to prevent passage of more than a predetermined number of stacked coins, such as by defining an opening equal to about 3.5 times a typical coin thickness). The coins move down the first trough 1310, where the pins 1322a and 1322b prevent passage of certain long objects such as lottery tickets and the like. A long object trap (if any) prevents passage of other types of objects such as popsicle sticks. Coins continue to flow down the second trough or chute 1312. Coins travel through the chute collar mouth 1334 and into the interior of the rotating trommel assembly 1338. Within the rotating assembly 1338 the coins are lifted and free-fall, at least partially, through the interior of the trommel, preferably at least partially in response to provision of flat surfaces, corners, and/or vanes within the trommel. As the coins free-fall or are otherwise agitated by the rotating trommel, dirt particles or other non-coin objects pass through the holes of the trommel and fall into the tray 1382. Coins travel through the trommel, e.g., in response to angled disposition of the vanes and the inclination of the trommel, if any. In general it is believed that a larger angle provides for shorter residence time, but less thorough cleaning or lifting of the coins. Thus the angle selection may require a compromise between the desire for thorough cleaning and the desire for short residence time (which contributes to higher throughput). The depicted configuration, when the trommel rotates at about 36 RPM, and using a typical mixture of U.S. coins, provides a coin residence time of approximately 10 seconds. Under these conditions, throughput during normal use is believed to be sustainable at about 600 coins per minute or more. Configuration and operating conditions can be adjusted to increase or decrease throughput, e.g., by changing the size, length or capacity of the trommel, increasing rotation rate, changing vane configuration or angles, and the like,

within structural constrains for desired durability, lifetime and maintenance costs. The coins, after being at least partially cleaned, exit the second opening 1364 of the trommel, and are directed by the output chute 1374 in an output direction 1320 toward downstream components such as the hopper of a coin transport/discrimination device.

Preferably, operation of the device is monitored, such as by monitoring current draw for the motor 1338. In this configuration, a sudden increase or spike in current draw may be considered indicative of an undesirable load and/or jam of the trommel assembly 1338. The system may be configured in various ways to respond to such a sensed jam such as by turning off the motor 1352 to stop attempted trommel rotation and/or reversing the motor, or altering motor direction periodically, to attempt to clear the jam. Jamming or undesirable load can also be sensed by other devices such as magnetic, optical or mechanical sensors. In one embodiment, when a jam or undesirable load is sensed, coin feed is stopped or discouraged, e.g., by closing gate 1324 and/or illuminating a "stop feed" indicator 1328b.

On page 12, starting at line 15 and continuing through line 24:

Preferably, openings 326 are as large as possible to accommodate large non-coin matter without undesirably diverting or hindering the feed rate of smaller diameter coins. A number of factors may affect the choice of hole sizes. As described below, internal vanes, fins, ridges and other projections may be positioned, e.g., on the inside surface of the cylinder, and there must be sufficient remaining surface to allow these projections to be attached and/or formed. The size of the holes and/or the spacing and/or pattern of the holes may affect the strength or load capacity of the cylinder 318. Removing non-coin debris is important, and having a large amount of open surface area (total surface area of all holes in the cylinder 318) tends to increase the effectiveness of eliminating large objects, including large, dense and/or odd-shaped objects. However, the total area occupied by holes in the drum, while being desirably as large as feasible, should not be so large as to cause the cylinder to lose structural integrity, having a small than desired load capacity, and/or be subject to unwanted deflection or failure.

On page 13, starting at line 31 and continuing through page 14 line 2:

A number of devices for accommodating rotation of the tumbler 318 can be used. The tumbler assembly may be supported by a pillow block 702 (Fig. 7), a roller-